FIXED CO2 SYSTEMS

ENABLING OBJECTIVES

- DESCRIBE the function, purpose, component parts, operating characteristics and procedures, safety considerations, and maintenance requirements for Fixed Hose Reel and CO2 Fixed Flooding Systems

CARBON DIOXIDE (CO_2)

- Inert gas, odorless, colorless, heavier than air
- Displaces oxygen
- Effective and **preferred** agent for Class “C” fires
- Effective agent for Class “B” fires

SAFETY PRECAUTIONS

- Can cause suffocation
- Frostbite (releases at -110 degrees F)
- Material must be allowed to cool since CO2 provides ***no reflash protection***
- Avoid contact of horn with electrical circuits

PROPERTIES

- Non-conductive
- Non-corrosive
- Leaves no residue

PURPOSE OF SYSTEM

- CO2 Fixed Flooding System
  - Used to protect unmanned compartments from flammable liquid fires
  - Some systems may be used to protect machinery spaces
- CO2 Hose Reel
  - Provide local application of CO2 to a fire

FIXED FLOODING INADVERTENT ACTIVATION

- 13MAY71 - 30JUL92:
  - 6 SAILORS DEAD
  - 6 SAILORS INJURED

30 JULY 92: DEATH OF 3 SAILORS IN PAINT MIXING ROOM

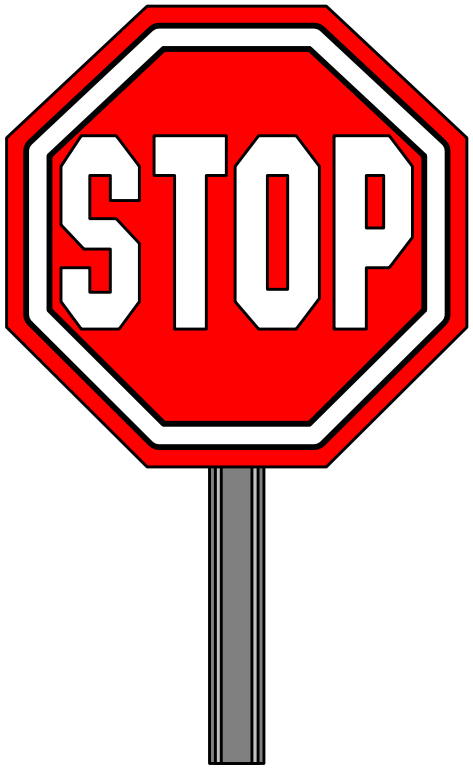
- Incorrect components installed (no time delay, alarms inaudible outside of protected space)
- Overpressurization of space during activation (door opened **into** space)
- Complete **whiteout**

- LESSONS LEARNED -

- Failure in the PMS system to establish stringent safety precautions regarding CO2 Fixed Flooding System

AUGUST 1992: ALL PMS ON CO2 SUSPENDED

- NAVSEA ISSUED SYSTEM SAFETY REVIEW
- PMS REVIEWED
- SYSTEM REVIEWED
  - 98 SYSTEMS



CHANGES TO PMS

- Must wear OBA
  - For visual inspection, OBA's worn in standby Q-1R
  - Donned for weighing A-1
- Must conduct a Safety Brief
- Block open inward doors
- Establish escape path
- Post warning signs
- Establish comms
- Assign 2 CPR qual. personnel

CO2 FIXED FLOODING SYSTEM

CO2 FIXED FLOODING SYSTEM

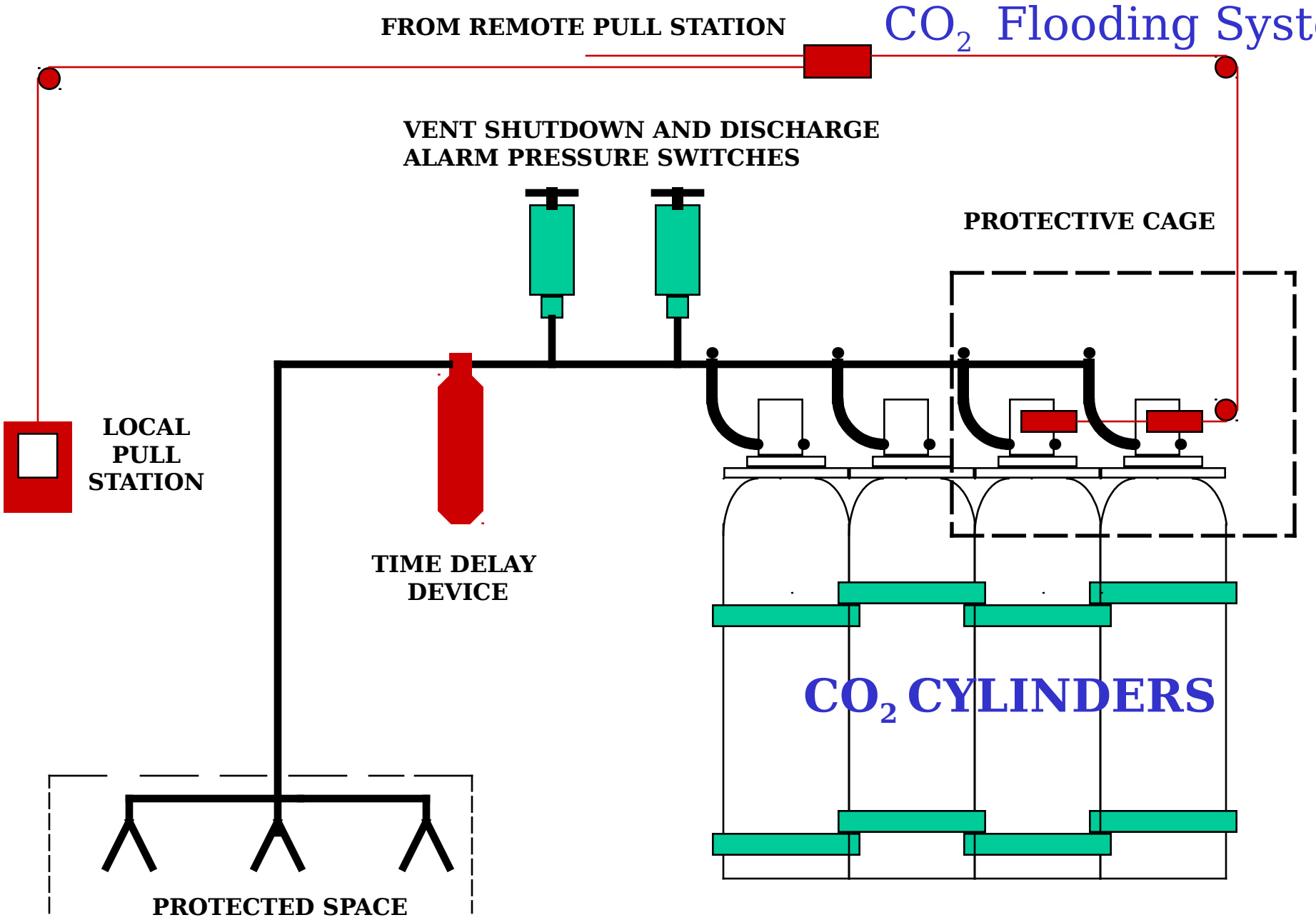
- Installed in spaces that require protection of flammables
  - Paint Locker
  - Paint Mix and Issue Room
  - Flammable Liquid Storeroom
  - Flammable Compressed Gas Cylinder Storeroom

50 LB. CO_2 CYLINDERS

- Non-shatterable
- Cylinder valves
  - Held closed by pressure in CO_2 cylinder
  - Manual or pneumatically activated
  - Safety disc 2650-3000 psi
  - Points for attachment of control and discharge heads

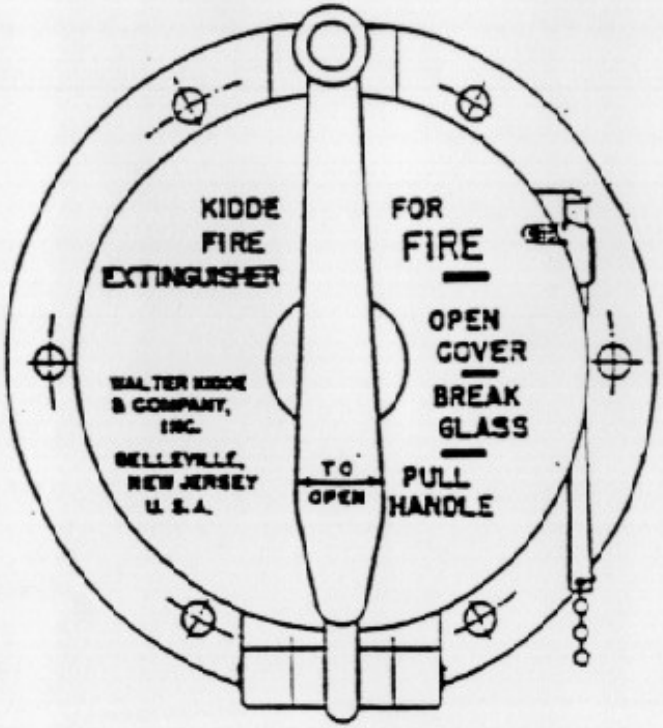
CO_2 FIXED FLOODING SYSTEM

- Discharges CO_2 from group of CO_2 cylinders into space
- Actuation of system causes release of **all** CO_2 into discharge manifold
- Entire protected space is flooded with CO_2 gas

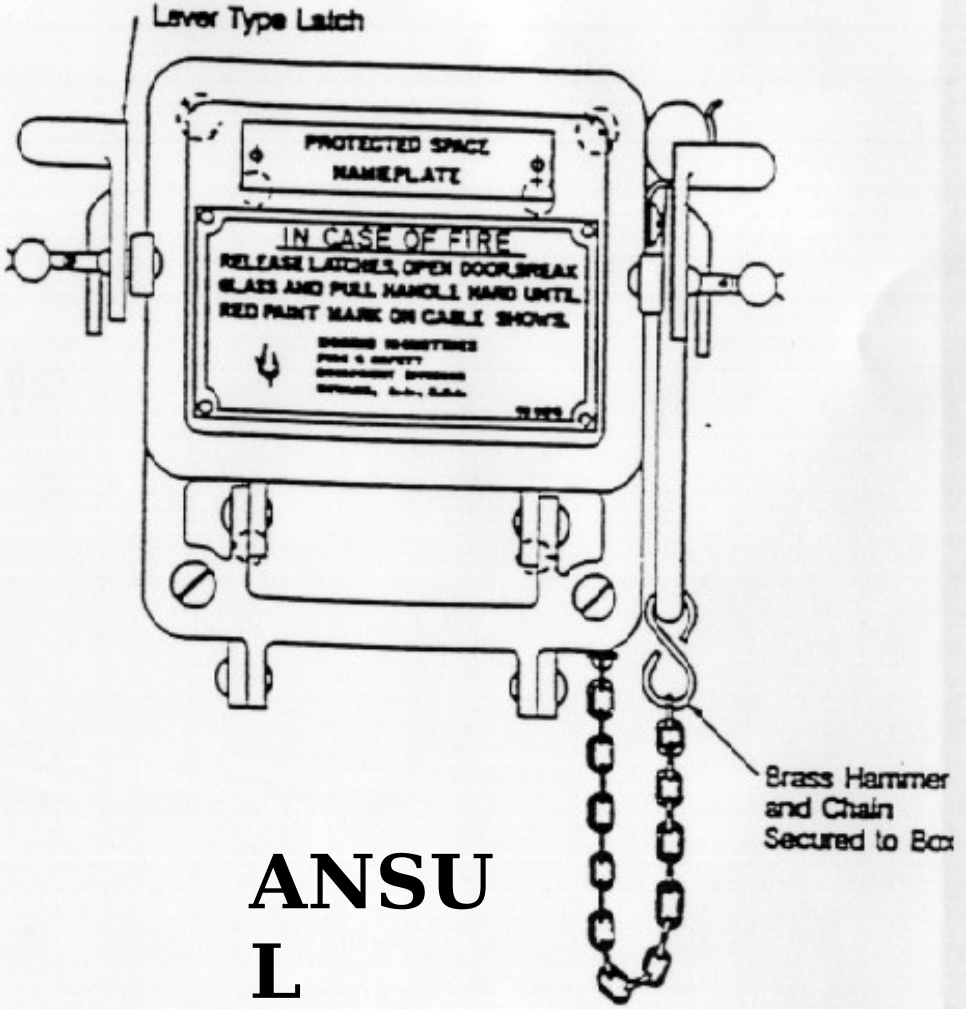

FROM REMOTE PULL STATION
CO_2 Flooding Syste
VENT SHUTDOWN AND DISCHARGE
ALARM PRESSURE SWITCHES
PROTECTIVE CAGE
LOCAL
PULL
STATION
TIME DELAY
DEVICE
CO_2 CYLINDERS
PROTECTED SPACE

CO_2 FIXED FLOODING SYSTEM
COMPONENTS

- WATERTIGHT BREAK GLASS PULL BOX
  - Located outside space for remote operation
  - Glass cover w/small hammer
  - Tee-handle attached to pull cable



KIDDE



ANSUL

TYPICAL WATERTIGHT BREAKGLASS PULLBOX

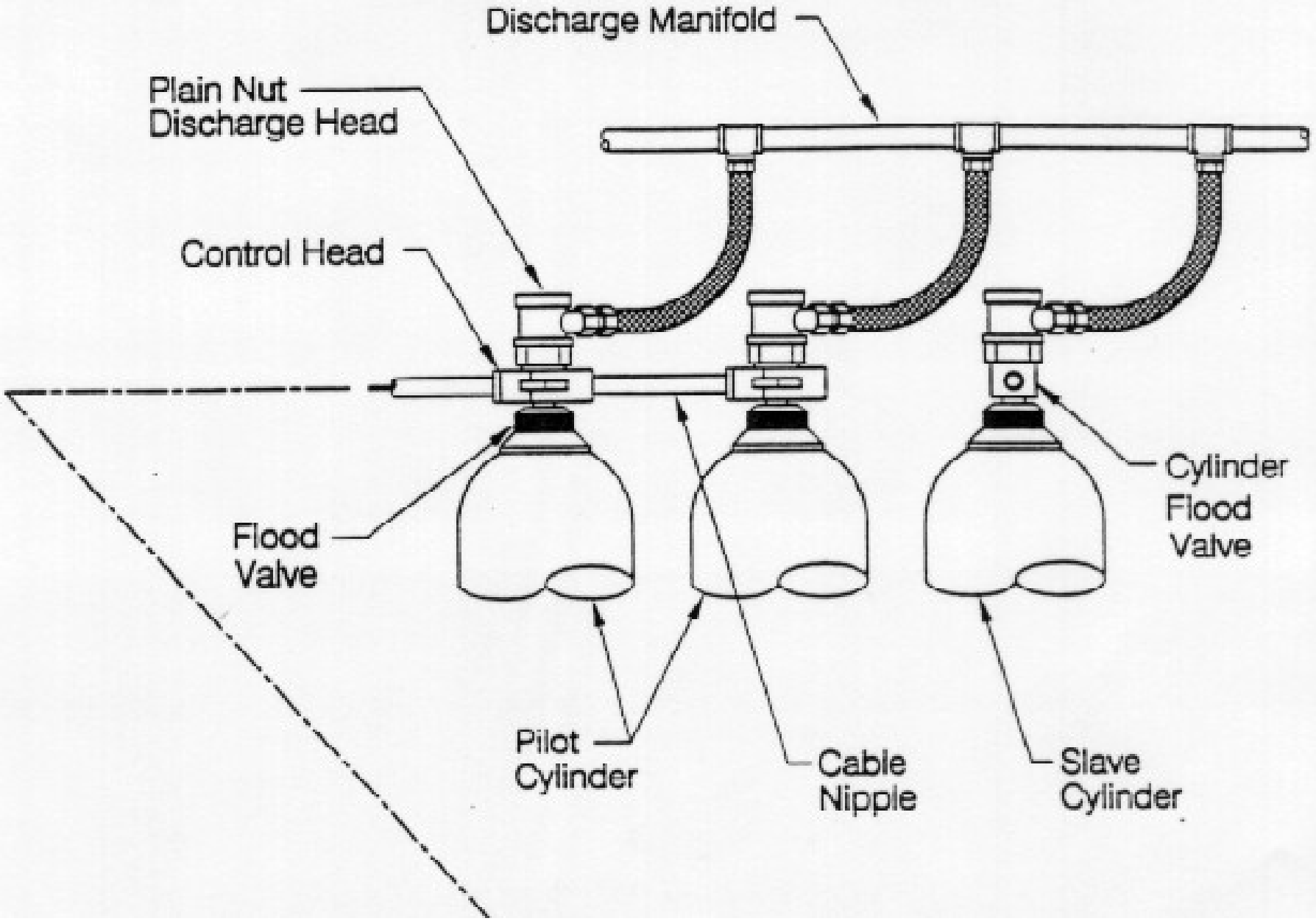
COMPONENTS CONT.

- CABLE ASSEMBLY
  - Routed from pull box to control heads via conduit and corner pulleys
- CABLE OPERATED CONTROL HEAD
  - Activation component for control cylinders
  - Attached to threaded connection on CO2 cylinders
  - Pulling cable advances wheel/lever assy. Serves as plunger to release CO2 from cylinder

COMPONENTS CONT.

- CONTROL CYL.
  - Activated by cable operated Control Head
  - Bottles must be <u>individually</u> bracketed to prevent any movement that might set off system
- PRESSURE OPERATED CYL.
  - Activated by CO2 pressure in discharge manifold
  - Installed downstream of control cylinders
  - Individually bracketed

S9555-D1-MMO-010



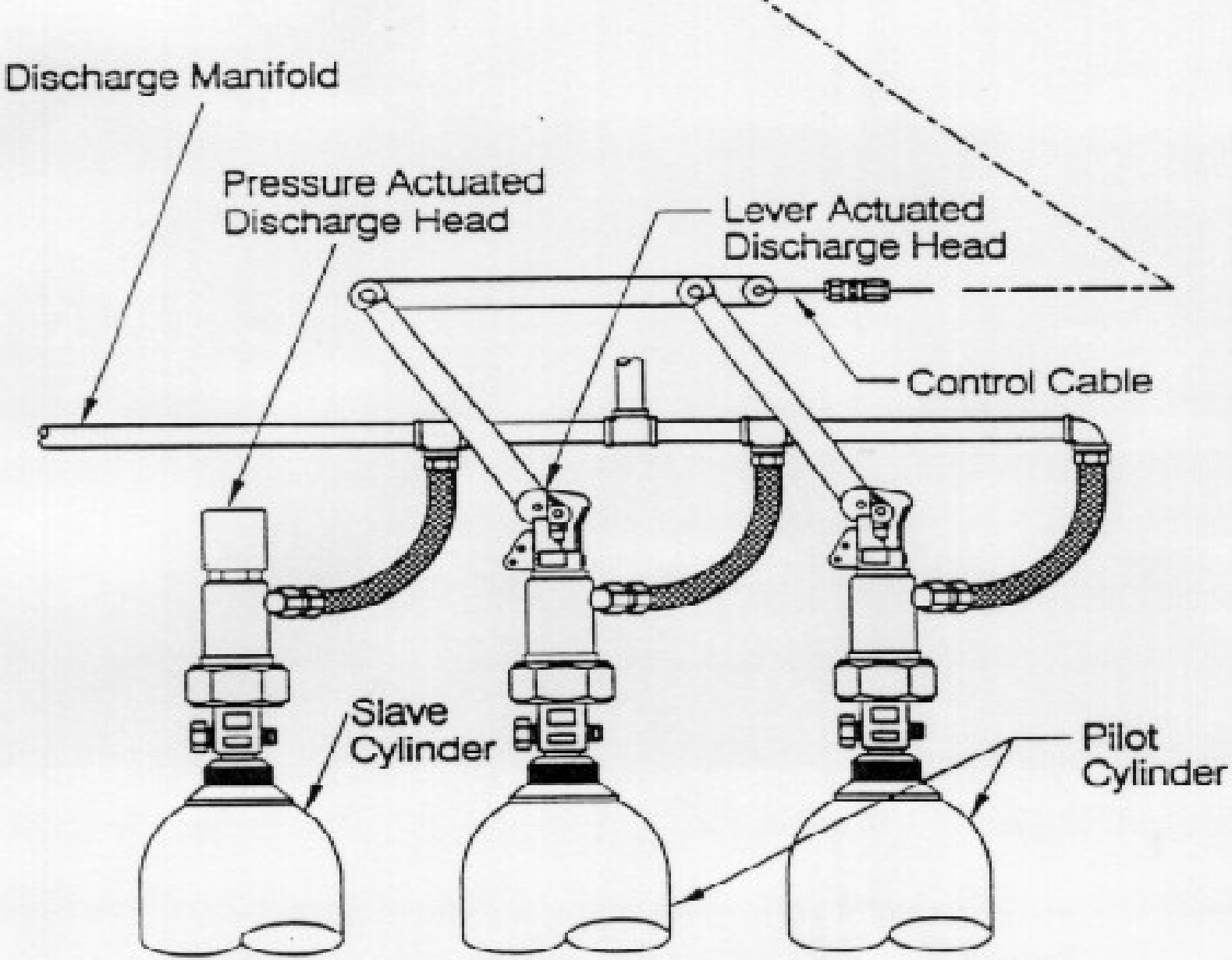
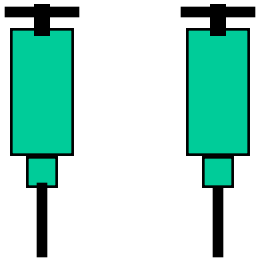


Figure 1-3. Ansul Actuation Mechanism Hardware, CO_2 Fixed Flooding System.

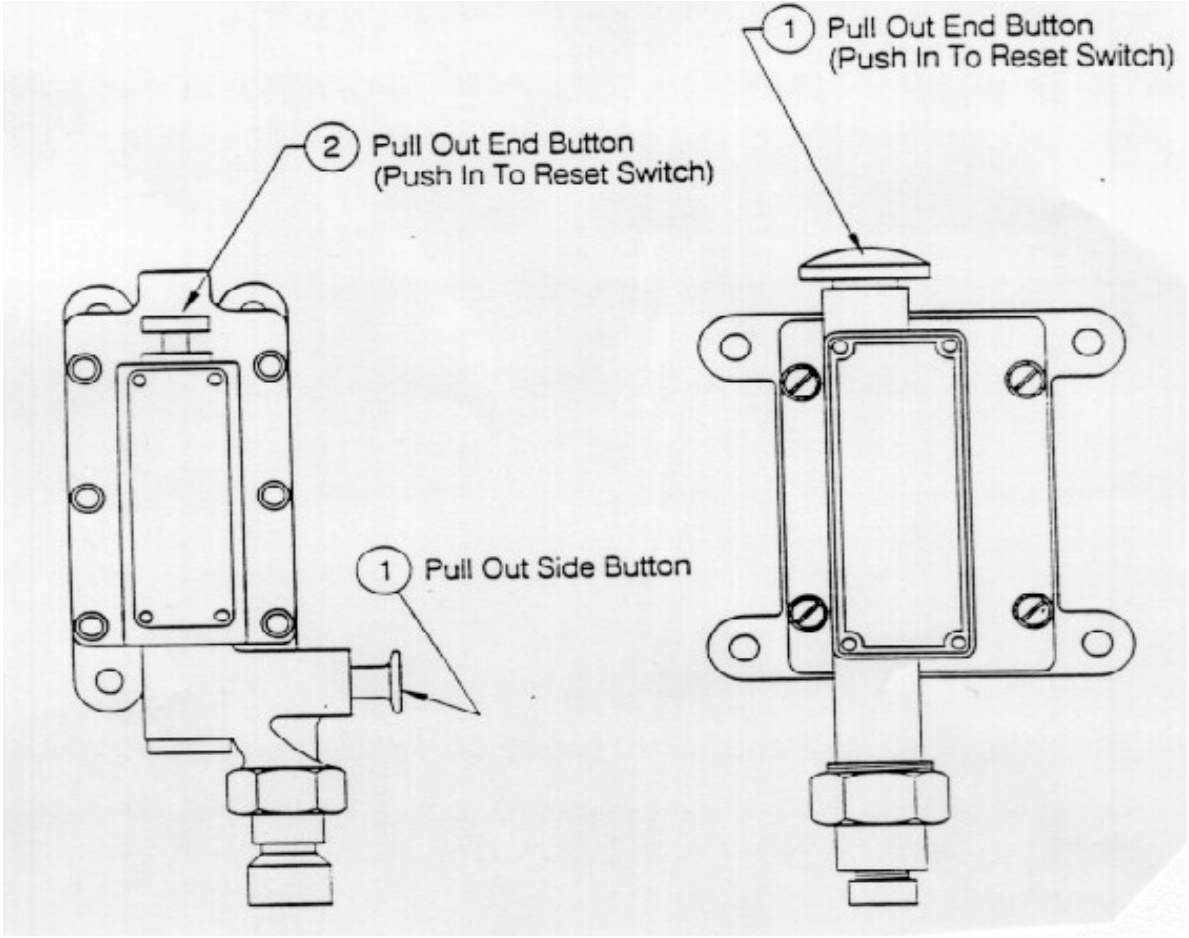
COMPONENTS CONT.

- PRESSURE OPERATED SWITCHES
  - ACTIVATED BY CO2 PRESSURE

VENT SHUTDOWN AND DISCHARGE ALARM PRESSURE SWITCHES



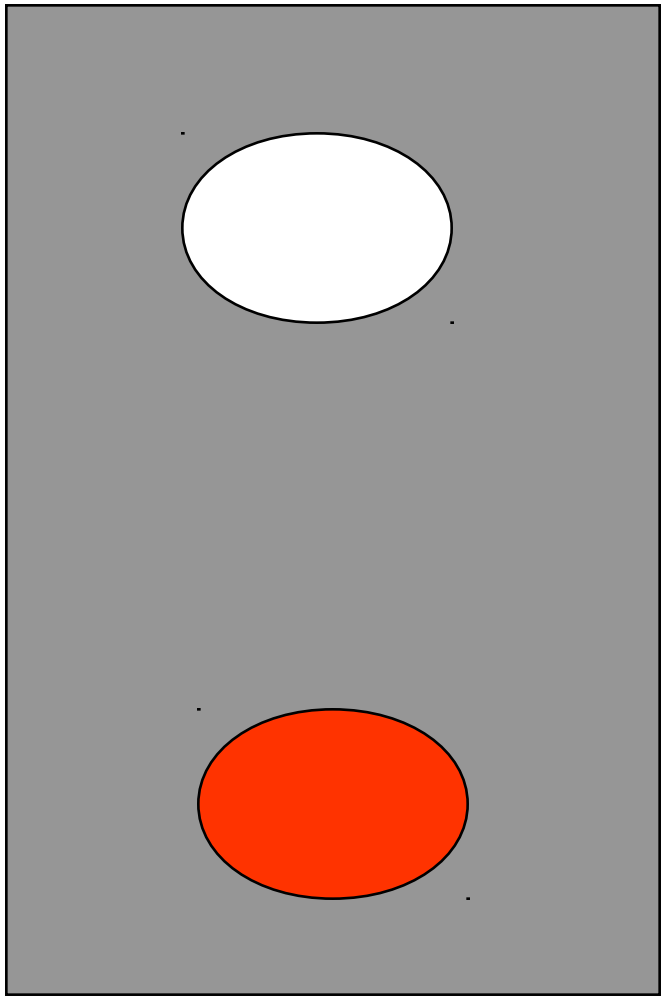
- **ALARM CIRCUITS**
  - AUDIBLE BELL IN PROTECTED SPACE
  - AUDIBLE BELL OUTSIDE SPACE
  - ALARM INDICATORS (DCC, BRIDGE, QD)
- **VENTILATION SHUTDOWN**
  - SECURES SUPPLY AND EXHAUST VENTILATION



KIDDE **ANSUL**

MANUAL OPERATION OF PRESSURE SWITCHES

CO2 INDICATOR LIGHT PANEL



WHITE

POWER AVAILABLE

RED

CO2 DISCHARGED

COMPONENTS CONT.

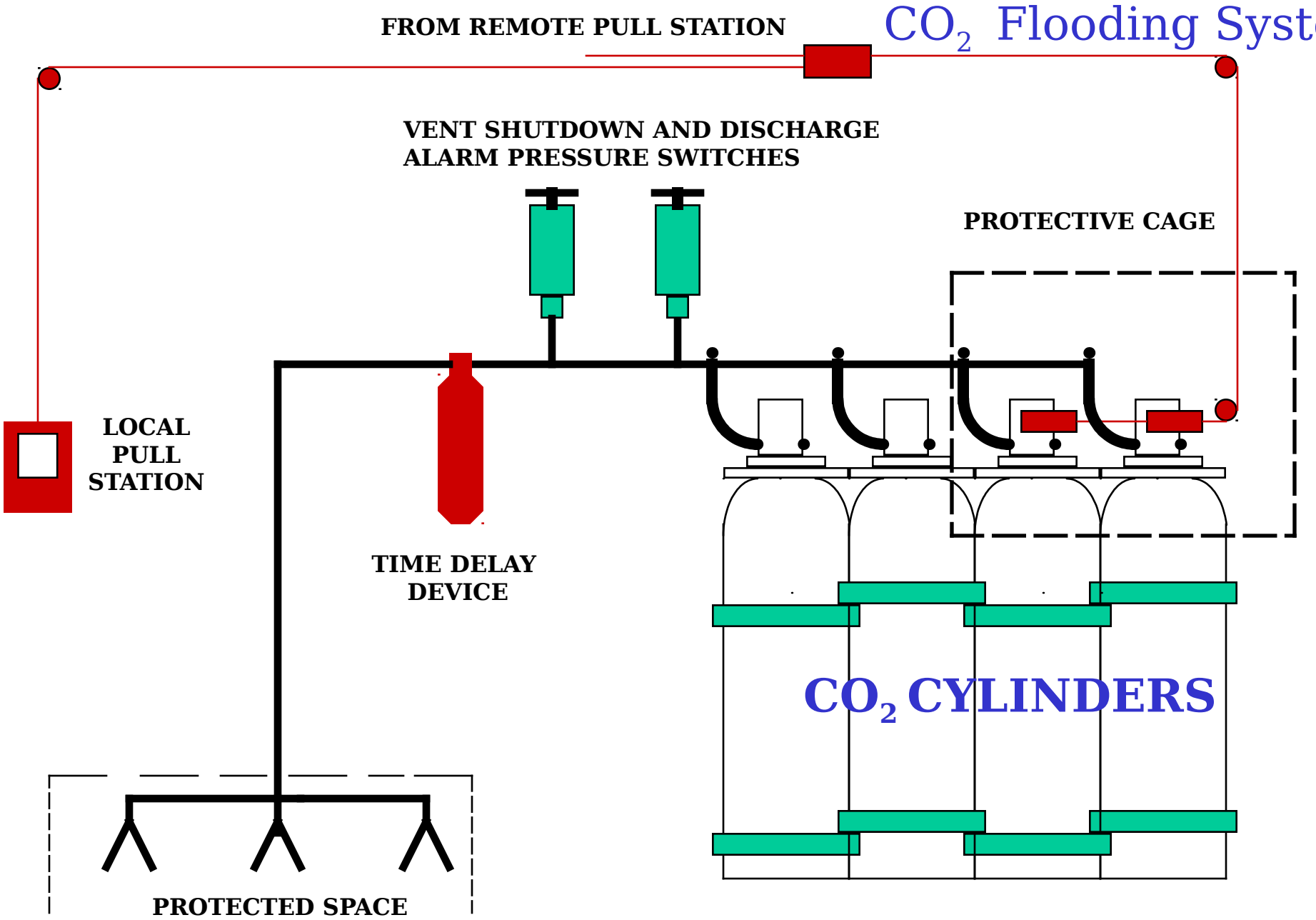
- TIME DELAY DEVICE
  - Allows ventilation to shut down
  - Allows personnel to escape from space
  - 25 second delay

TIME DELAY DEVICE

- DISCHARGE PIPING
- MULTI-JET DISCHARGE NOZZLES
  - Sufficient no. to distribute CO2
  - Ensure nozzles are not obstructed

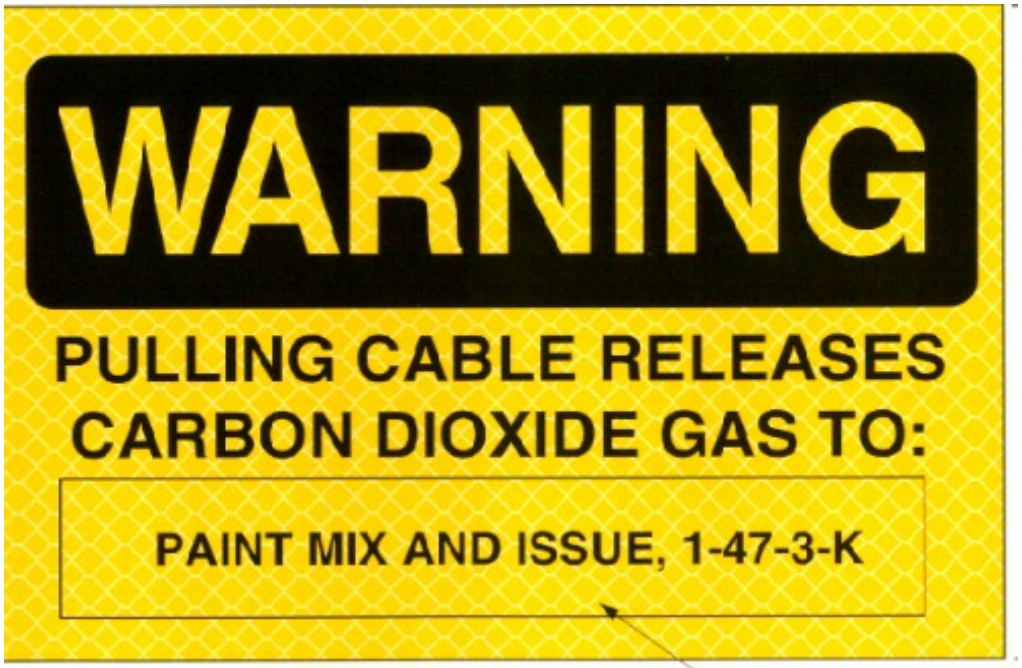
ACTIVATION PROCEDURES

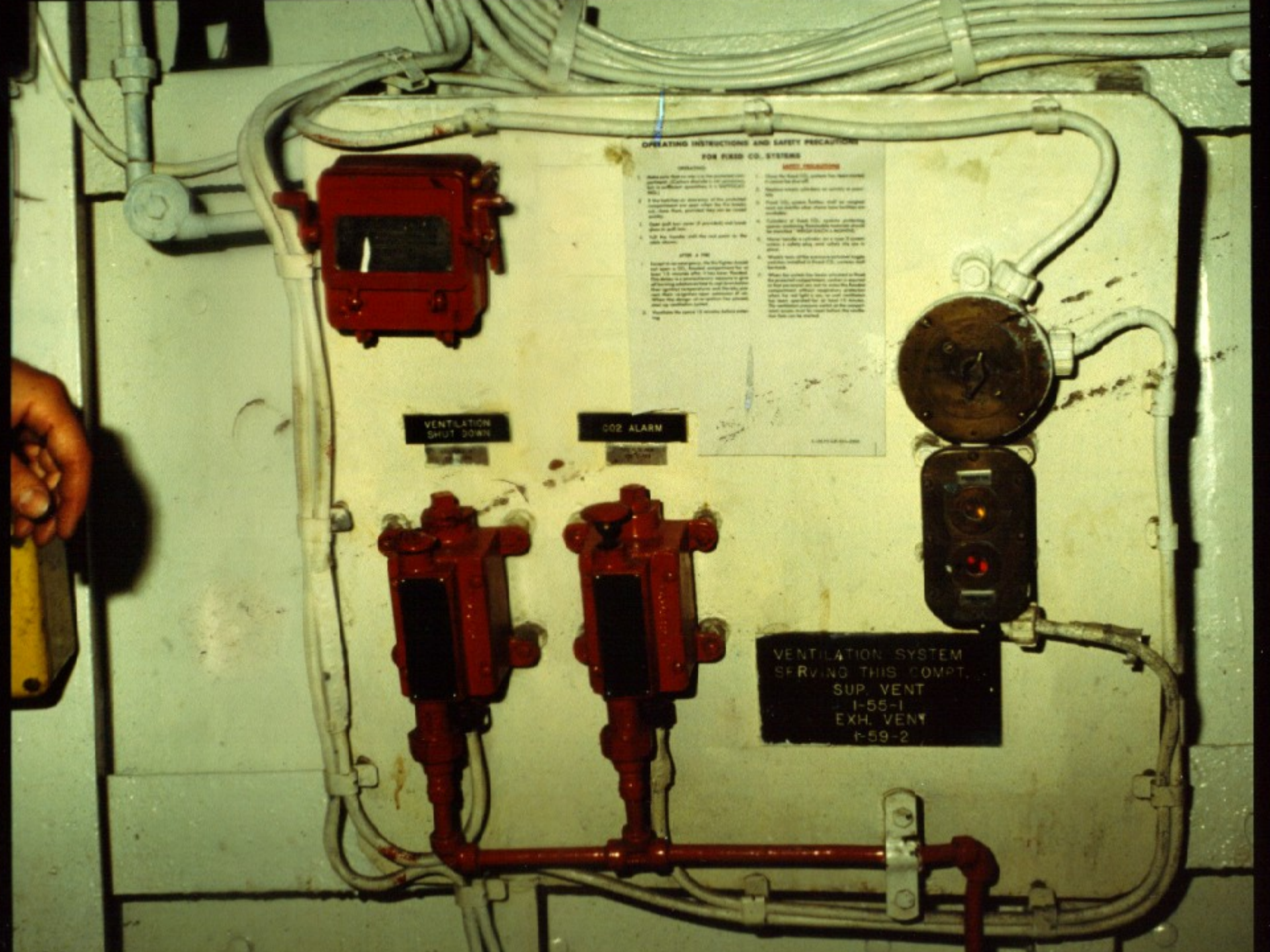
- Break glass on pullbox cover
- Grasp handle and pull hard
- Pull cable out 3-5 inches or until **red** paint appears


FROM REMOTE PULL STATION
CO_2 Flooding Syste
VENT SHUTDOWN AND DISCHARGE
ALARM PRESSURE SWITCHES
PROTECTIVE CAGE
LOCAL
PULL
STATION
TIME DELAY
DEVICE
CO_2 CYLINDERS
PROTECTED SPACE

3M Part Number 3MN301DG

WARNING
STAY CLEAR OF PROTECTIVE CAGE
FOR CO_2 FLOODING SYSTEM
DO NOT REACH BEHIND OR
REMOVE CAGE WITHOUT
AUTHORIZATION OF DCA


WARNING
PULLING CABLE RELEASES
CARBON DIOXIDE GAS TO:
PAINT MIX AND ISSUE, 1-47-3-K


OPERATING INSTRUCTIONS AND SAFETY PRECAUTIONS
FOR FIXED CO2 SYSTEMS
VENTILATION SHUT DOWN
CO2 ALARM
VENTILATION SYSTEM SERVING THIS COMPT.
SUP. VENT
I-55-1
EXH. VENT
I-59-2

RECURRING MATERIEL DISCREPANCIES

- Cylinder mounting bracket discrepancies
- Cable nipples loose/missing
- Inadequate/ missing protective cages
- Alarms and time delay configuration problems
- Missing or inadequate warning signs

REENTRY PROCEDURES

- Keep space sealed for minimum of *15* minutes to allow space to cool
- Reenter with OBA's & charged hoses (AFFF)
- Potential is high for *reflash*

REENTRY PROCEDURES

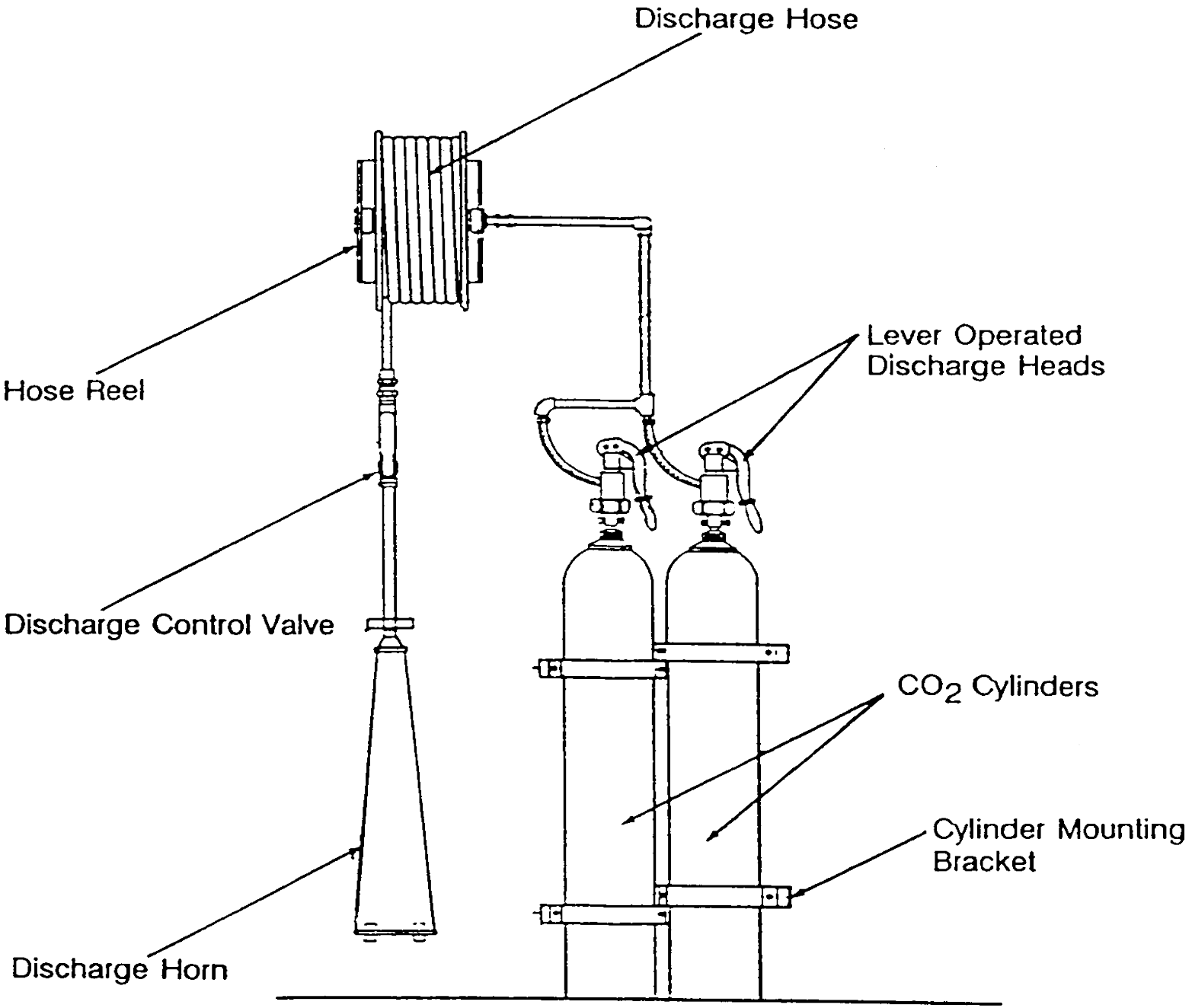
- Reset Vent Shutdown Switch if you use installed system for desmoking
- Operate vents on high for 15 minutes or use portable blowers

CO2 HOSE REEL SYSTEM

CO2 HOSE REEL SYSTEM

- Used in electrical and machinery spaces where potential for Class “C” fire is high
- Standard installation
  - 2-50 LB CO2 Cylinders
  - 50 Feet of Hose on reel
  - Valve & Horn Assy.

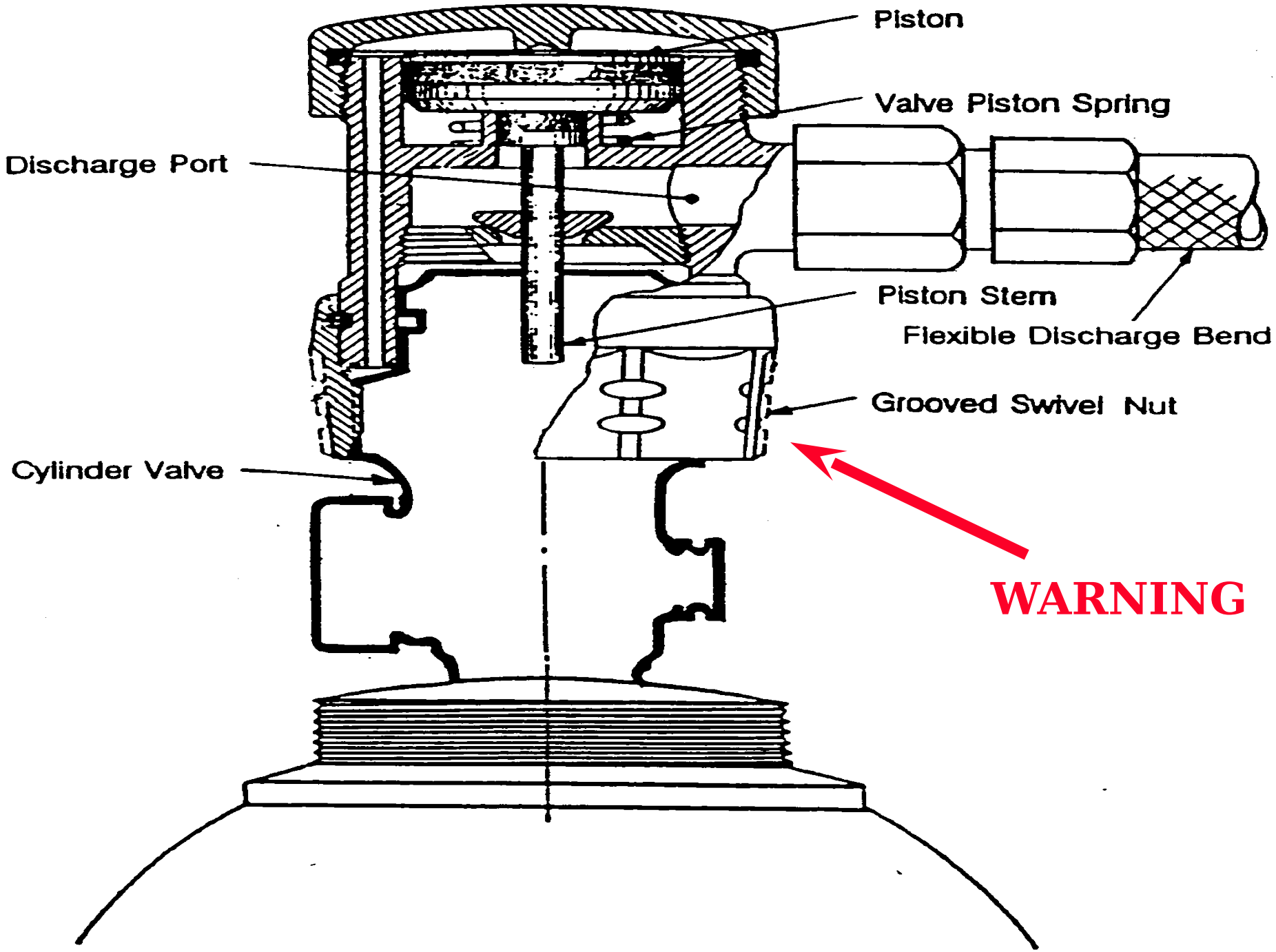
CO2 HOSE REEL



CO2 HOSE REEL CONT.

- **GROOVED NUT DESIGN**
- Allows for **individual** cylinder activation
- Position of ball valve changes when cylinder is activated

- **WARNING:**
- Grooved Nut Discharge Heads must be installed only on CO2 *Hose Reel* Systems - **not** CO2 Fixed Flooding Systems!


Piston
Valve Piston Spring
Discharge Port
Piston Stem
Flexible Discharge Bend
Grooved Swivel Nut
Cylinder Valve
WARNING

CO_2 HOSE REEL OPERATION

- Secure electrical power (recommend fighting and containing fire while concurrently securing power)
- Ensure nozzle valve is closed
- Break seal on **one** cylinder and remove pin

CO_2 HOSE REEL OPER. CONT.

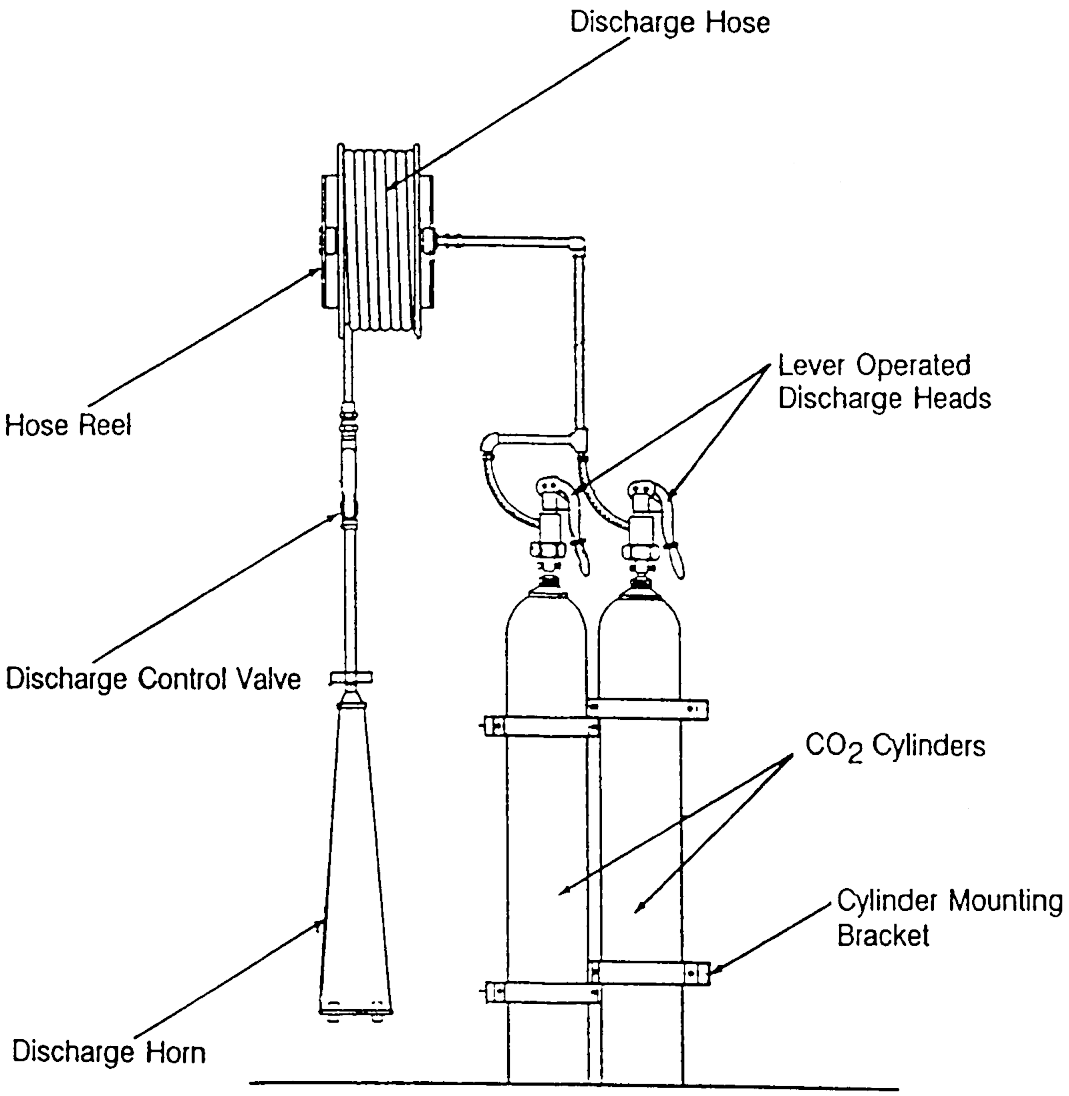
- Open cylinder valve on **one** bottle by turning CCW
- Remove horn & un-reel hose
- Squeeze nozzle valve
- Point at base of flame
- When one cylinder empties, repeat procedure

SUMMARY

- Use of CO2
- Safety Precautions
- 50 LB CO2 cyl.
- CO2 hose reel
- CO2 Fixed Flooding System
- Personnel hazards
- System components
- Activation/re-entry procedures
- Safety initiatives

QUESTION #1

- WHAT ARE THE ACTIVATION PROCEDURES FOR A CO2 HOSE REEL?

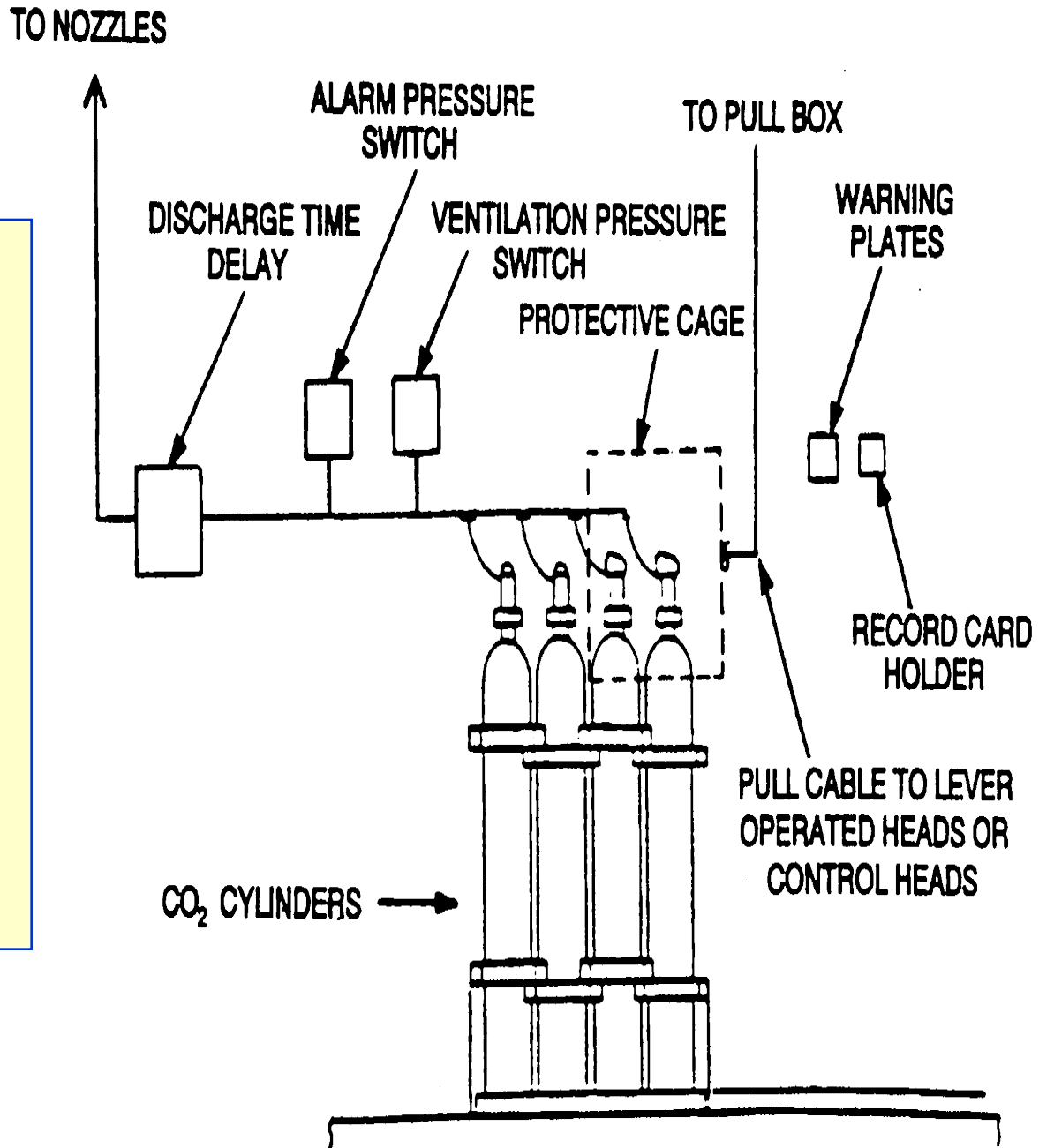


ANSWER

- OPEN CYL. VALVE ON **ONE** BOTTLE BY TURNING CCW
- REMOVE HORN & UN-REEL HOSE
- SQUEEZE NOZZLE VALVE
- POINT AT BASE OF FLAME
- WHEN ONE CYLINDER EMPTIES, REPEAT PROCEDURE

QUESTION #2

- WHAT ARE THE ACTIVATION PROCEDURES FOR A CO2 FIXED FLOODING SYSTEM?



ANSWER

- BREAK GLASS ON PULLBOX COVER
- GRASP HANDLE AND PULL HARD
- PULL CABLE OUT 3-5 INCHES OR UNTIL **RED** PAINT APPEARS
- THIS ACTUATES LEVER MECHANISM WHICH ACTUATES DISCHARGE HEAD

THE END

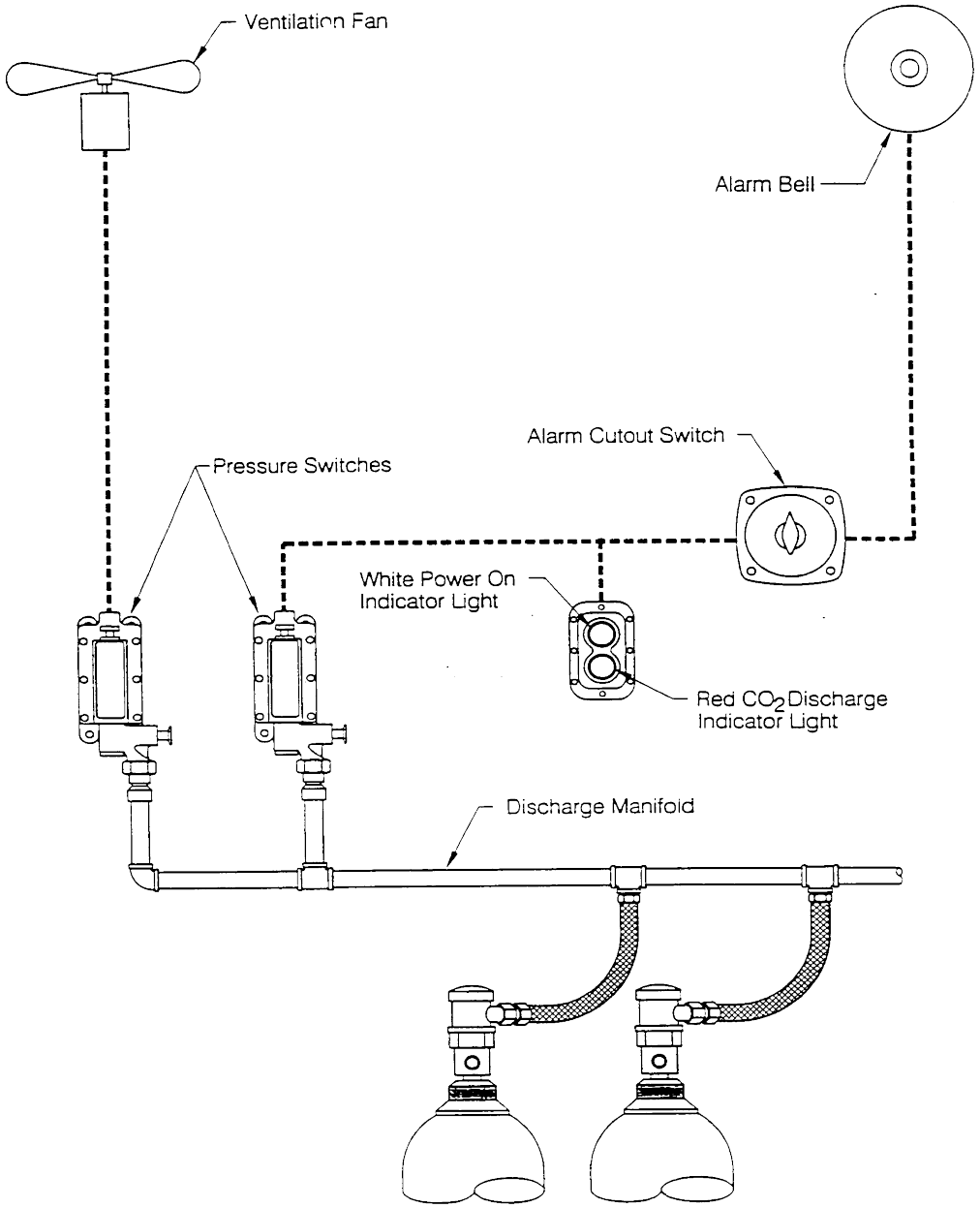


Figure 1-4. Alarm and Ventilation Fan Interlock Mechanism